



## HAWAII COOPERATIVE EXTENSION SERVICE

College of Tropical Agriculture and Human Resources

University of Hawaii

GENERAL HOME GARDEN SERIES No. 20

### SOIL SALINITY

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Salinity is the presence of soluble salts in the soil. Soluble salts may be detrimental by increasing the salt concentration of the soil solution. High concentration of salts in the soil solution directly reduce plant growth.

#### Sources of Salinity in Soils

Soluble salts in the soil may originate during the process of soil formation. These salts remain in the soil due to lack of sufficient rainfall to remove them or due to poor internal drainage so that they cannot be removed. Poor internal drainage may be due to layers of restricted drainage or to high water table so there is nowhere for the water to go.

Soluble salts may accumulate in the soil from the use of irrigation water high in salts. The brackish water used in some areas is a major source of salts. If the water has more than 90 grains of salt (1500 ppm), the water is too high for safe use. In many areas where water with less than 90 grains is used, salts accumulate because insufficient water is added to remove any accumulated salts. When the soil is allowed to dry, the salts accumulate in the soil as the water evaporates from the surface, or is taken up by the plants, leaving the salts behind.

Excess salinity may also occur when too much fertilizer containing nitrogen and potassium salts is added to the soil. Salinity from this source is generally a temporary situation, the excess salts being removed due to uptake by plants or leaching by rainfall or irrigation. The use of animal manures containing soluble salts is another major source of salinity. Salinity from this source is usually temporary also.

In the home garden, damage due to salinity is most often the result of use of excessive amounts of fertilizer, placing the fertilizer too close to plants, or using animal manures with excessive amounts of salts. Home gardens located near beach areas often exhibit salt damage due to salt water spray or intrusion from the ocean.

#### How To Determine Salinity

Visual observation of the soil and plants is one method of determining if a salinity problem exists. The appearance of a white crust on the soil may indicate the presence of excessive salts. These salts accumulate as water moves up through the soil bringing the salts with it. As the water evaporates, the salts accumulate on the surface. However, dangerous amount of salts may exist in the soil with no signs of salt on the surface. This results in bare areas, poor and spotty germination of seed, poor spindly plants or plants with marginal and/or interveinal "burning" on the leaves. Visual observation of the soils and plants, however, is seldom reliable for proper diagnosis of soil salinity. The only reliable method is to have the soil tested for salinity.

Soil samples should be taken from suspected areas of salinity and submitted to the Soil Testing Laboratory of the Department of Agronomy and Soil Science of the College of Tropical Agriculture and Human Resources. You may obtain assistance from your County Agricultural Agent in taking and submitting soil samples. You must request the salinity test as this is not a routine test and will not be performed unless requested.

The results of the soil test are given in terms of electrical conductivity expressed as millimhos per cubic centimeter at 25°C. This is a numerical value based upon the fact that increasing soluble salts in water will increase the electrical conductivity of the water in proportion to the amount of salts present in the solution. If the electrical conductivity of the solution (salinity) is 2 millimhos/cm or less, any plant can be grown safely in that soil. If it is 2 to 4 millimhos/cm, any plant but the most sensitive may be grown, 4 to 8 only moderately sensitive and above 8 only tolerant plants. If above 16, very few plants will grow.

#### How To Correct Salinity

The best practice with respect to salinity is to prevent its development. This means following

recommendations for fertilizers, manures and other materials that may contain salts. Just because a little is good a lot more is not necessarily better but may lead to serious problems. The use of water low in salts is best. If it is necessary to use water containing salts, then the soil must be watered sufficiently to provide the leaching necessary to avoid salt accumulation. The soil must also be kept moist to avoid salt accumulation.

The only effective way of treating salinity in the home gardens of Hawaii is the removal of the salts from the soil. This requires a well drained soil with a natural water table below five feet as water moves too slowly and salts tend to remain in the soil except in very porous soils if the water table is above this level. Most of the salinity problems in Hawaii develop because soil drainage is poor. Irrigation of such soils by flooding should be avoided. Rather, irrigation methods which allow lower water applications are more favorable.

If possible, mixing the soil with organic residues such as bagasse, sawdust, peat moss, etc., will reduce

salinity and mixing with uncontaminated soil will also reduce salinity. This generally is not feasible except with small volumes of soil. Placing a layer of top soil over the contaminated soil is at best a temporary measure as salts will eventually work their way up, due to evaporation from the surface of the top soil, and contaminate that soil. Plant roots also grow down into the soil underneath and are affected by the salts in that layer.

Growing salt-tolerant plants in saline soils is a possible means of utilizing these soils. However, as the soils become more saline, the more limited is the choice of plants available for use on these soils.

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**NOTE:** The use of trade names is for the convenience of readers only and does not constitute an endorsement of these products by the University of Hawaii, the College of Tropical Agriculture and Human Resources, the Hawaii Cooperative Extension Service, and their employees.

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